



ARM

CLIMATE RESEARCH FACILITY

Recovery Act Contributions to ARM Infrastructure and ASR Science and Broadening Contributions through Field Campaigns

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Instrument and Field Campaign Coordinator

March 15, 2010



U.S. DEPARTMENT OF
ENERGY

Office of
Science

Presentation Outline

- Recovery Act Overview
- Collaborating through Field Campaigns
- Contacts and Information

Recovery Act: Introduction

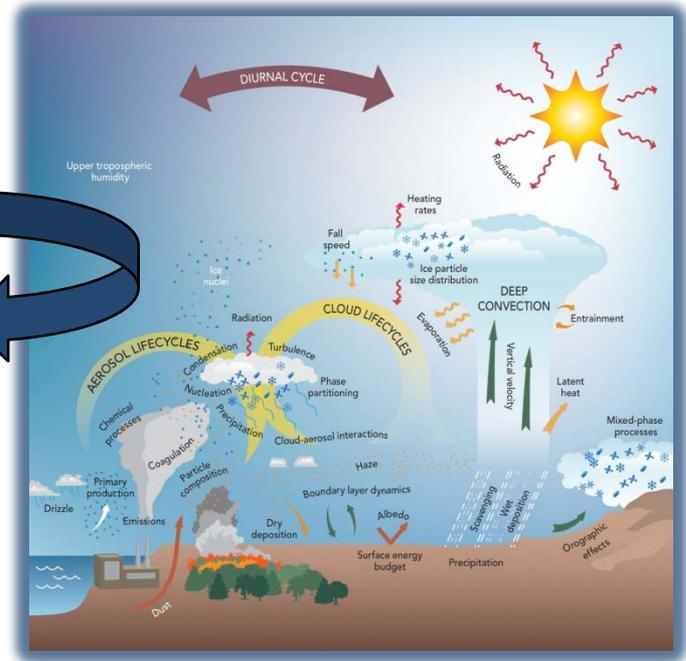
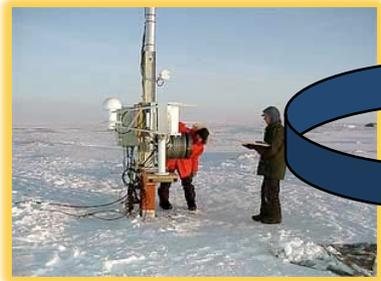
- \$60M from DOE Office of Science for investments in instrumentation and research infrastructure
- 3-dimensional measurements of cloud scale dynamics, microphysics, and precipitation
- Enhanced measurements of atmospheric aerosol composition and chemistry
- Enhanced measurements of cloud composition
- Enhance measurement base to bridge new knowledge into, and improve, the predictive performance of climate models

www.arm.gov/about/recovery-act



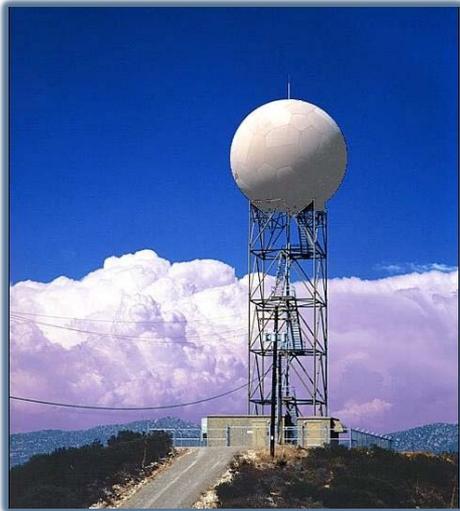
Recovery Act

Contributing to ARM Infrastructure and ASR Research



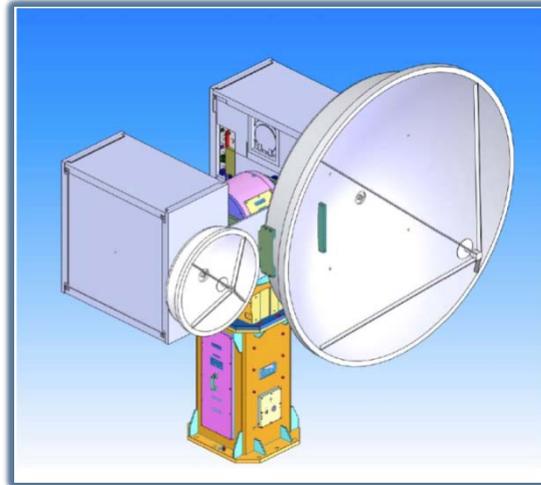
Recovery Act: Instrumentation and Measurements

Scanning Precipitation Radars



3-dimensional
precipitation
patterns

Scanning Dual Frequency Cloud Radars



Microphysical
structure
of clouds

Raman, High Spectral Resolution, and Doppler Lidar



Cloud and aerosol
properties,
updraft velocities,
water vapor

Recovery Act: Instrumentation and Measurements

3-Channel Microwave Radiometers



Precipitable water vapor and liquid water path

Infrared and Solar Spectrometers



Infrared and solar radiation, water vapor, and aerosols

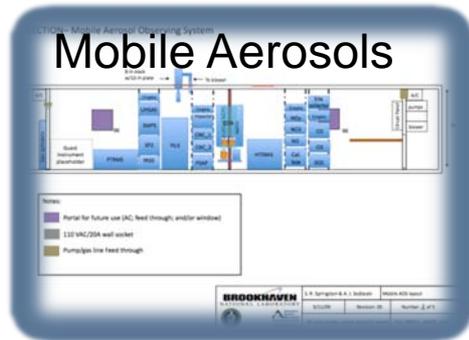
Expanded Surface Flux Network



Water vapor fluxes, latent and sensible heat, carbon dioxide

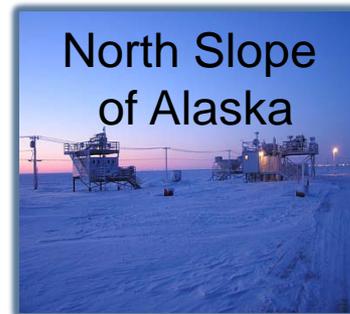
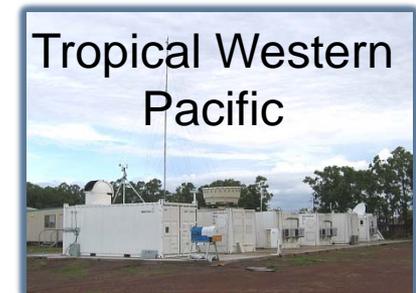
Recovery Act: Instrumentation, Measurements, and Infrastructure

Atmospheric Aerosols, Chemistry and Cloud Composition



Size distribution, concentration, composition, and chemistry

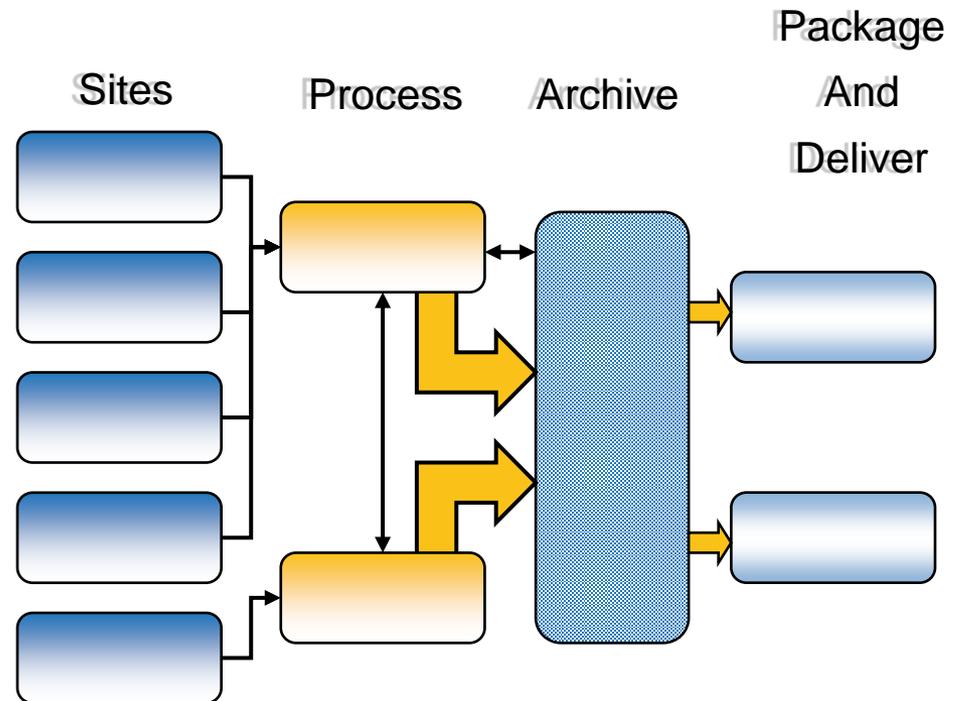
Research Site Infrastructure



New instrumentation siting and operational upgrades

Extensive Upgrades to Computing and Network Capacity

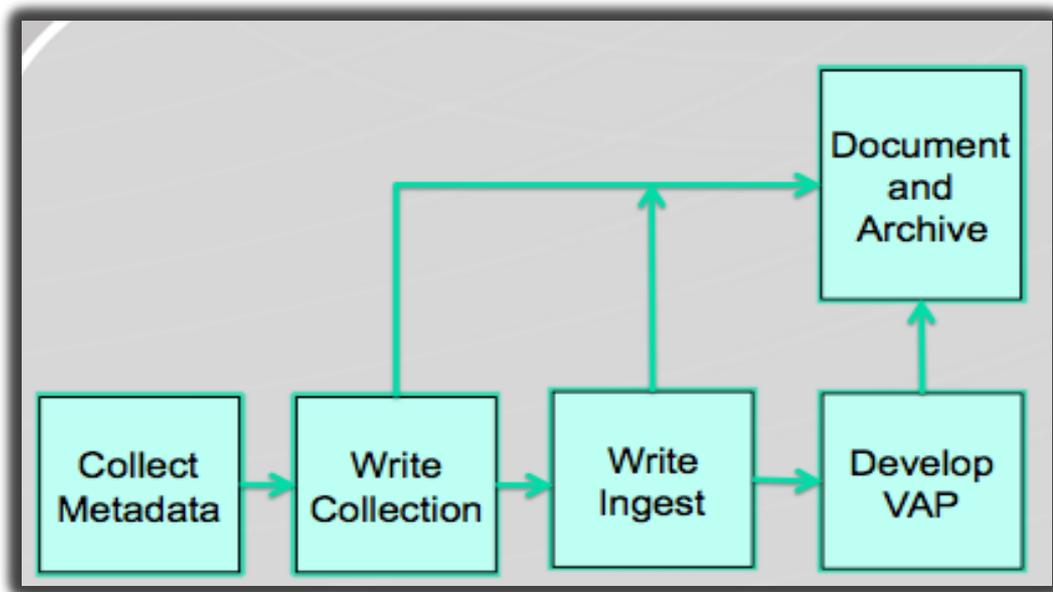
- Research Sites
- Data Management Facility
- Archive
- Network
- Storage



Resulting New or Revised Data Streams

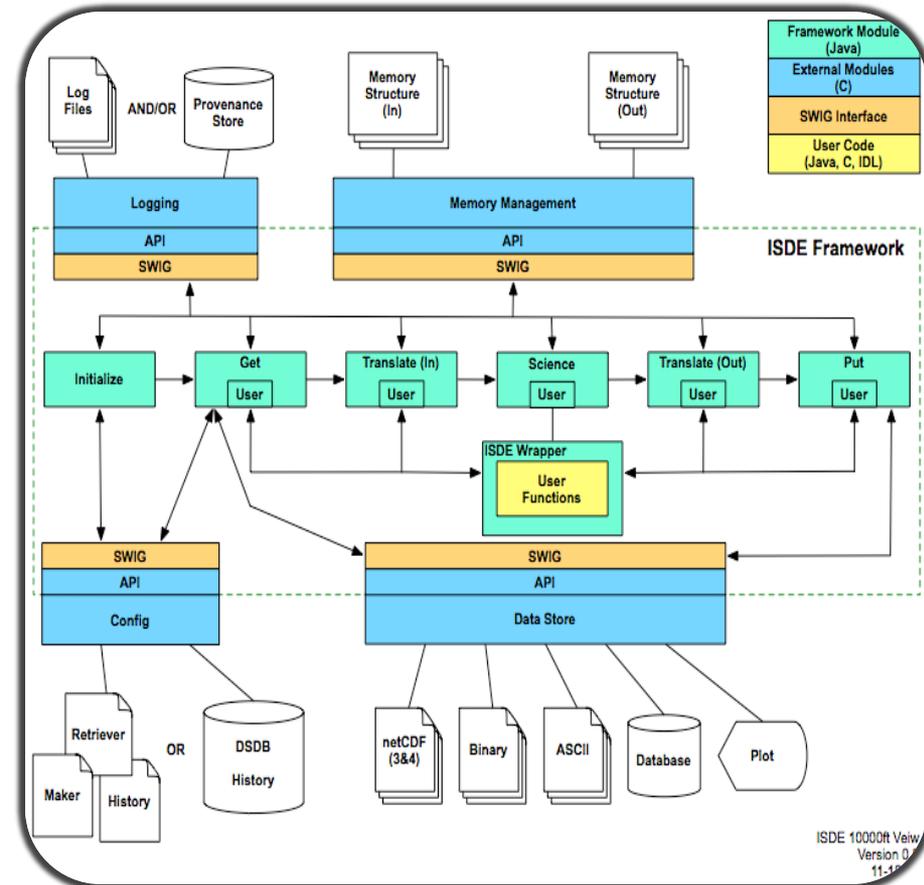
- **Collection, Ingest, and Delivery**

There are approximately 50 different instruments being introduced with a range of requirements.



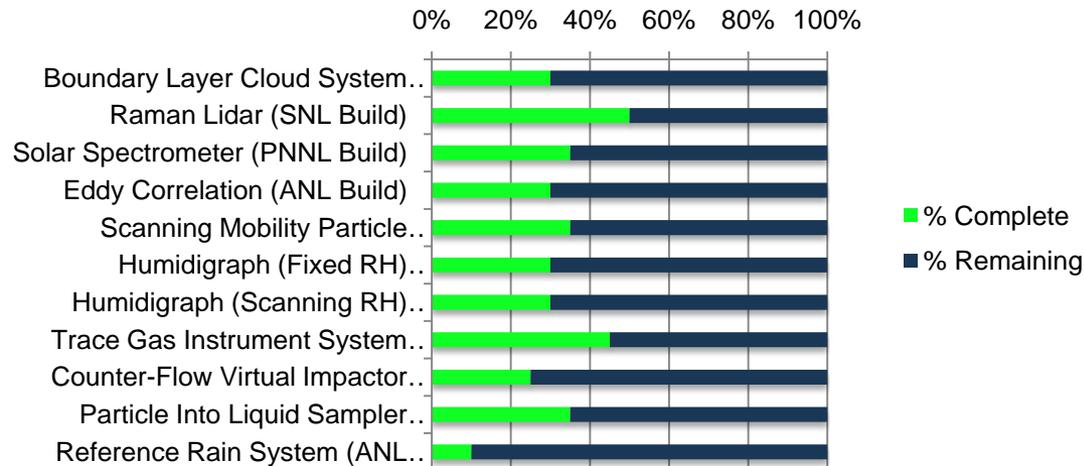
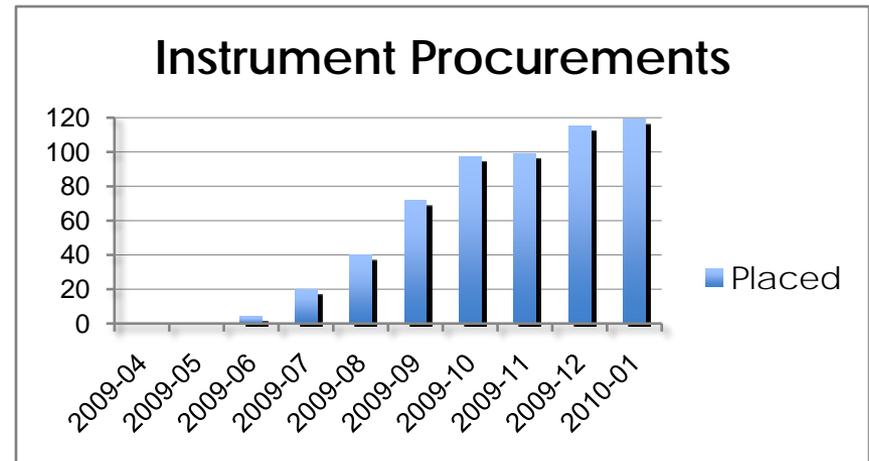
Integrated Software Development Environment

- Environment hosted at the ARM Archive
- To provide an improved user experience for scientist
- Standardized retrieval, translation, and storage
- Community approach to code development
- Framework to analyze and process large data sets
- Capability for external code integration



Progress and Where We Are

- 100% of baseline instruments and contracts are placed
- 30% of the baseline instruments have been received
- All tasks are on track





Recovery Act - Closing Points

- Contact Jimmy Voyles at jimmy.voyles@pnl.gov
- Stop by our poster
- Visit the Recovery Act website for a complete summary of instruments and progress

www.arm.gov/about/recovery-act

Recovery Act Instruments: Deployment and Data Processing Plans
J. W. Voyles, J. H. Mather
Pacific Northwest National Laboratory

1. Introduction
\$40M in capital investments for instrumentation and research infrastructure.
Over 120 individual procurement actions and 50 datastreams.
Accelerated procurement and implementation plan.
Provide 3-dimensional measurements of cloud scale aerosols, microphysics, and precipitation.
Provide enhanced measurements of atmospheric aerosol composition and chemistry.
Enhance ARM measurement bases to bridge new knowledge into, and improve, the predictive performance of climate models.
A list of instruments being purchased is available here: <http://www.arm.gov/about/recovery-act>

2. Complementing Atmospheric System Research Objectives
Process Research and Modeling: Properties of, and interactions among, aerosols, clouds, precipitation, and radiation.
Basis of atmospheric dynamics, thermodynamics, structure, radiation, surface exchanges, and chemical and microphysical processes in the life cycle of aerosols and clouds.
Identify and quantify key processes among the aerosol cloud precipitation cycle that affect the radiative fluxes of the surface to the top of the atmosphere and the radiative and latent heating rate profiles.
Supporting laboratory and field measurements, integrated data products, evaluation, and analysis.

3. Principal Measurement Groups And Supporting Infrastructure
Scanning-Radiation Imager
Reference Rain Network
Scanning Dual-Frequency Cloud Radar
Lidar for Clouds and Aerosols
Multi-Frequency Microwave Radiometer
Infrared and Solar Spectrometers
Supported Surface Flux Network
Atmospheric Aerosol and Chemistry
Atmospheric State
Research Site Infrastructure, Computing and Networking

4.1 Accelerated Evolution into 3-Dimensional Measurements of Cloud Life Cycle
Volume Resolved Cloud Properties, Precipitation, Aerosols, Dynamics

4.2 Synergistic Aerial Measurements of Aerosols and Cloud Composition
In Situ Cloud Particle and Aerosol Composition, Concentration, Size Distributions, and Chemistry

4.3 Enhanced Ground-Based Aerosol and Atmospheric Chemistry
Clouds, Precipitation, Precipitation, Water Vapor, and Dynamics

5. Project Status
All tasks are on track.
Design Reviews for key tasks completed.
95% of the project tasks are committed.
32% of the project is coded.
100% of baseline instruments (20 procurements) are procured.
25% of the baseline instruments have been received.
Target 85% of project coded by FY2010 and Project completion by January 1, 2011.

6. Datastream Availability and Processing Workflow Improvements
Input, Collection, and Delivery: These are implemented as different instruments being introduced with a change of Cooled Neutronium, Wet Collection, Wet Ingest, Drying VAP, and Output and Archive.
Integrated Software Development Environment: Provides improved user experience of scientists. Standardized retrieval, ingestion, and storage. Community approach to code development. Framework to analyze and process large data sets. Capability for external codes to be plugged into the ARM production pipeline. Environment hosted at ARM Archive.

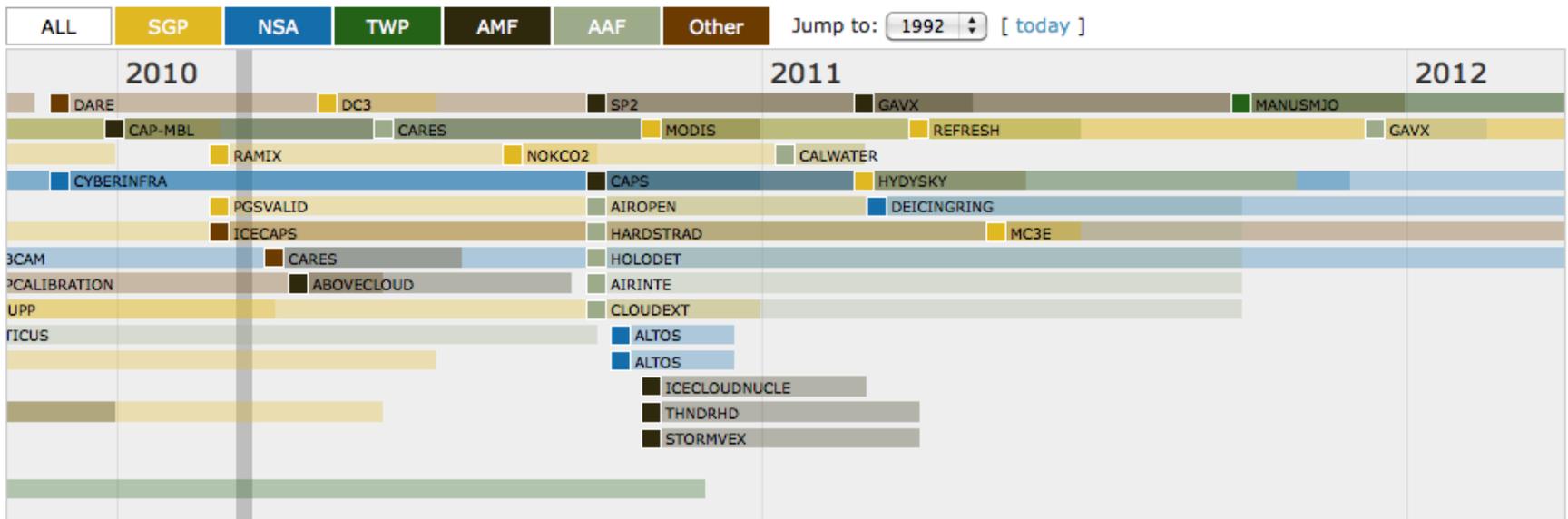
7. Near Term Priorities
Radar Site Preparations
Aerosol Enclosure Integration
Instrument Delivery and Integration
Site Infrastructure Enhancements
Computing and Network Infrastructure
Datastream Ingest and Development
Integrated Software Development Environment

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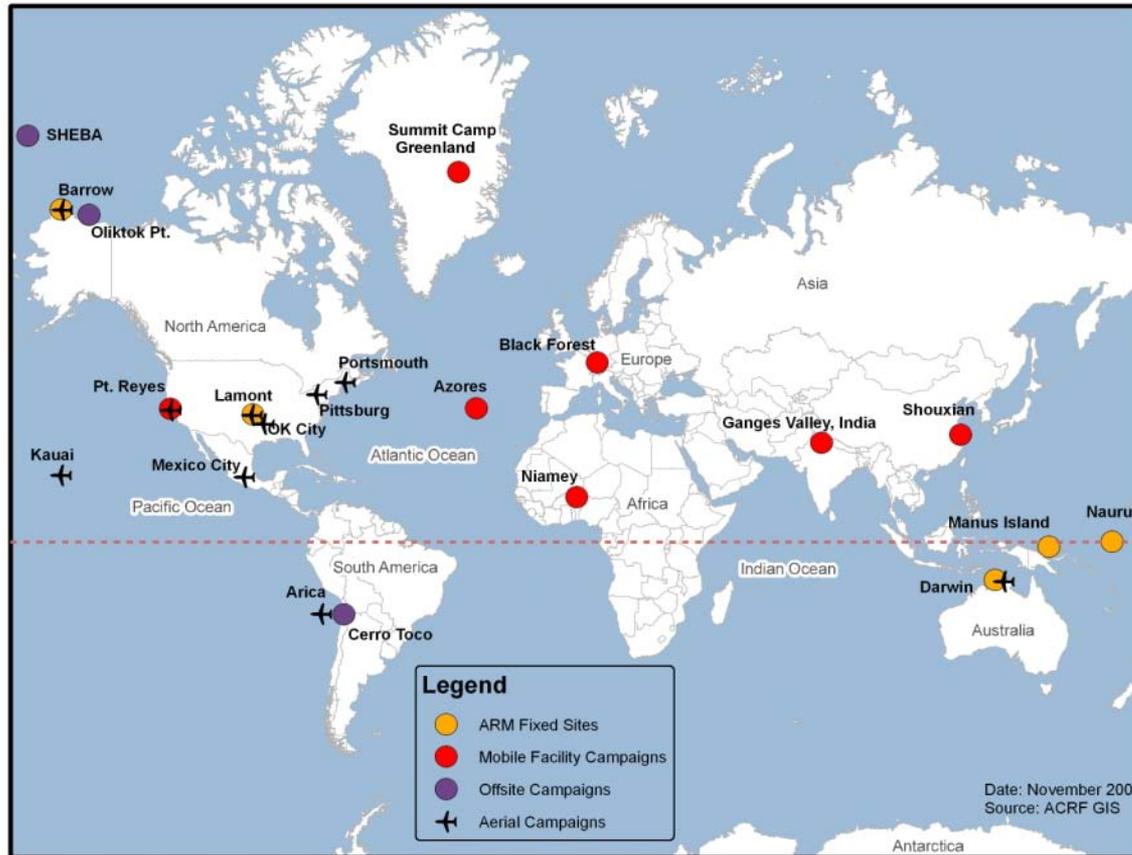
Field Campaigns

<http://www.arm.gov/campaigns>

Enhancing Interactions– When Standard ARM Data may not be Enough



Field Campaigns



Field campaigns provide the opportunity to augment observations at fixed sites or extend measurements to undersampled regions.

Field Campaign Capabilities: Fixed Sites



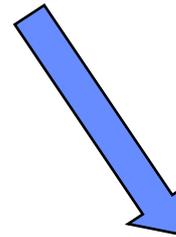
Southern Great Plains



Tropical Western Pacific



North Slope of Alaska



May through June 2011

Mid Latitude Continental
Convective

Clouds Experiment (MC3E)

October 2011 through March 2012

Observations of the Madden Julian
Oscillation for Modeling Studies - AMIE
(ACRF MJO Investigation Experiment)

Field Campaign Capabilities: ARM Mobile Facility 1

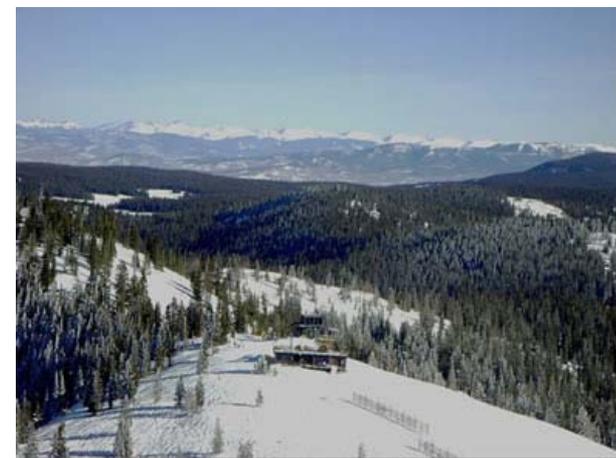
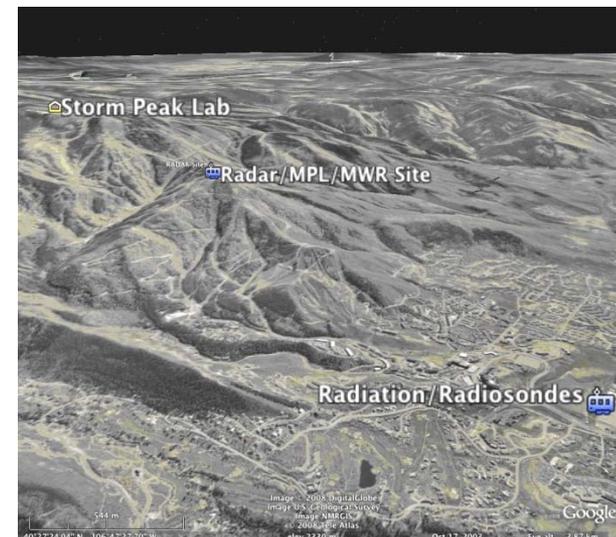
- “Portable site” obtains data from under-explored climate regimes
- Instruments, operations shelters, data systems, and on-site technicians
 - Since 2005, deployed to California, Africa, Germany, and China
 - Currently in the Azores for the Cloud, Aerosol, and Precipitation in the Marine Boundary Layer (CAP-MBL) campaign; May 2009 – December 2010



Field Campaign Capabilities: ARM Mobile Facility 2



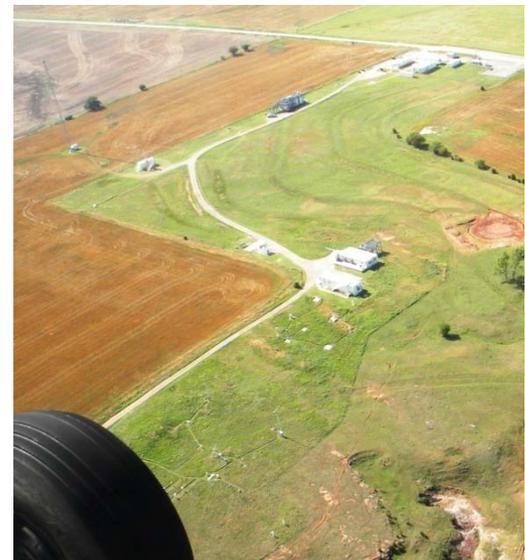
- Increased modularity and robustness to accommodate space restrictions and marine environments
- New instruments to measure
 - Bulk aerodynamic fluxes
 - Ocean meteorology
 - Sea state and surface currents
- Storm Peak Laboratory Validation Experiment (STORMVEX) in Colorado; October 2010 – April 2011



Field Campaign Capabilities: ARM Aerial Facility



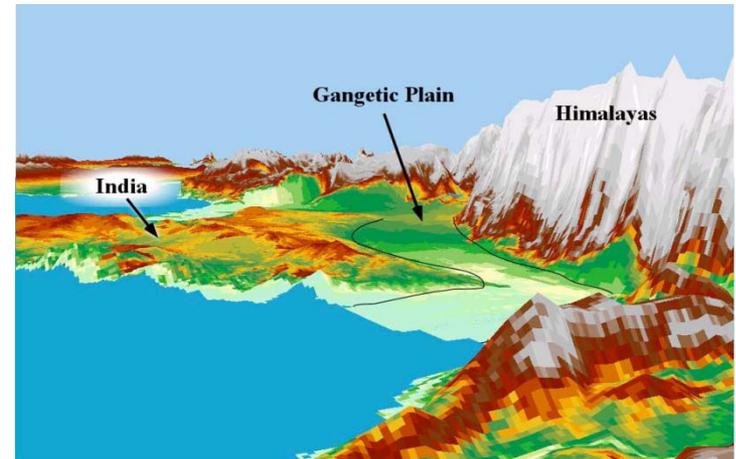
- In situ measurements for ground-based and satellite data validation
 - Small Particles in Cirrus (SPARTICUS) over the SGP site; December 2009 – April 2010
 - Carbonaceous Aerosol and Radiative Effects Study (CARES) in California; June/July 2010.



Field Campaign Capabilities: Combined AMF/AAF Campaign



- Ganges Valley Aerosol Experiment (GVAX) in India; April 2011 – March 2012
 - Combined AMF/AAF campaign
 - Will deploy the DOE G-1 aircraft
 - Researchers studying the impact of increasing aerosols on the Indian Summer Monsoon, specifically the impact on precipitation
 - In-country collaborators will provide complementary measurements



Field Campaign Capabilities: Mobile Assets

- Baseline instrument systems available for offsite deployments
 - Radiative Heating in Underexplored Bands Campaign 2 (RHUBC-II) in the Chilean Atacama desert; August – October 2009
 - ALTOS – Cloud properties measured from a tethered balloon near Oliktok, Alaska; October/November 2010
- Mobile Aerosol Observing System under development



Field Campaign Capabilities: Mobile Aerosol Observing System



- Instruments for collecting atmospheric measurements
 - Aerosol lifecycle (condensation particle counters, dual-column cloud condensation nuclei counter, nephelometer)
 - Atmospheric state (radar wind profiler, sodar system, weather transmitter)
 - Gases (trace gas instrument system, aerosol chemistry speciation monitor)



ACSM-002 SN 140-100

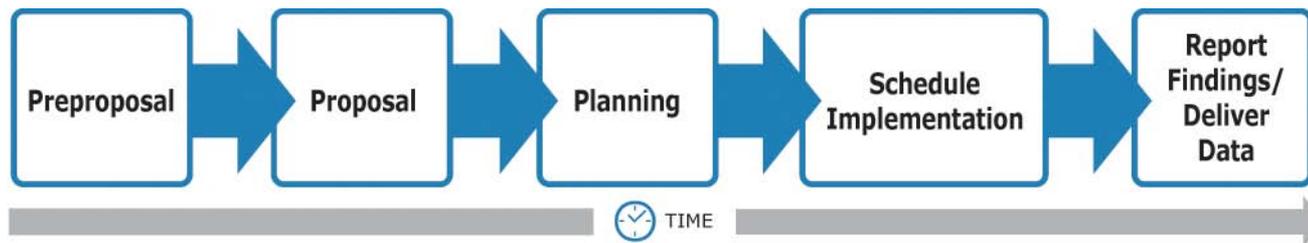
Additional Field Campaigns

- While there is an emphasis in large fixed Research Site, AMF, and AAF campaigns, many additional campaigns are supported.
 - SGP Cloud Tomography Experiment
 - Airborne carbon measurements
 - Various visiting instruments for tests or calibration



Annual Field Campaign Proposal Cycle

- Announcement – Call for Pre-Proposals; December for FY(n+2)
- Pre-Proposals due February for Review
- Invitation for Full Proposal; Mid-February
- Full Proposals Due; May for infrastructure review and logistical analysis
- Science Board Review
- Awards announced in September



Visit the Field Campaign Webpage

<http://www.arm.gov/campaigns>

■ Components of the Facility

- Mobile Facilities (AMF1, AMF2)
- ARM Aerial Facility
- Mobile Aerosol Observing System

■ Announcement Information: BAMS, EOS, EGU, or at

www.arm.gov

- Small proposals always welcome (e.g., guest instruments)

The screenshot shows the ARM Climate Research Facility website's 'Propose a Campaign' page. The page features a navigation menu with options like 'About', 'Science', 'Campaigns', 'Sites', 'Instruments', 'Measurements', 'Data', 'News', 'Publications', and 'Education'. The main content area is titled 'Propose a Campaign : Preproposal Form' and includes a search bar for 'Lead Scientist' and 'Co-Investigator(s)'. Below these are fields for 'Field Campaign / Instrument Proposal Name' and 'Field Campaign / Instrument Time Span'. A dropdown menu for 'ARM Site Designation' lists various sites such as AAF, AMF, NSA, OSC, SDSR, SGP, and TWP. The right sidebar contains sections for 'Schedule and Availability', 'Forms', and 'Documentation', each with a list of links and dates.

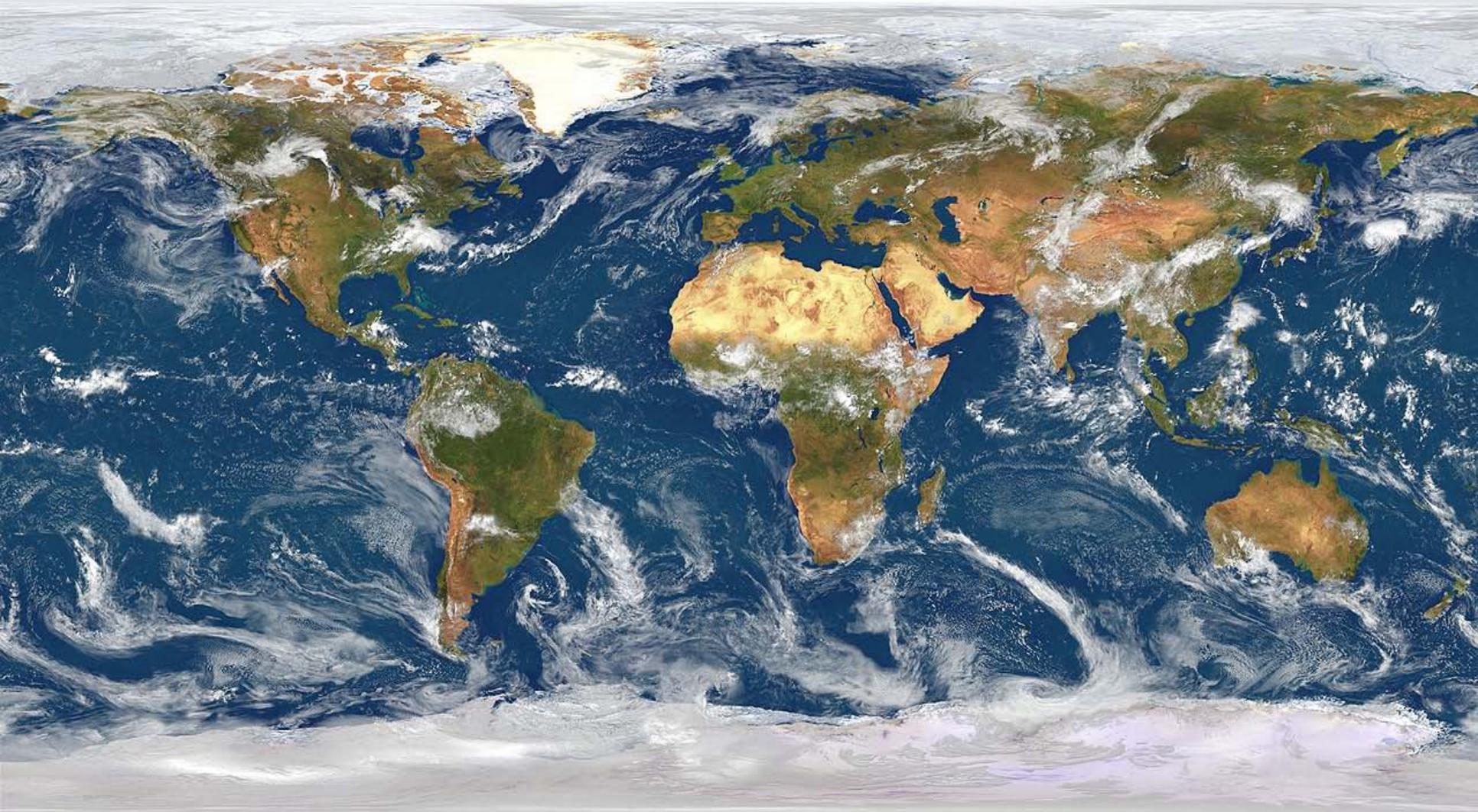
ARM Climate Research Facility Contacts and Information

- Provide feedback regarding instruments, data, etc.
(www.arm.gov/about/contact)
- Contacts:
 - Jim Mather, Technical Director – jim.mather@pnl.gov
 - Jimmy Voyles, Instrument and Field Campaign Coordinator –
jimmy.voyles@pnl.gov

Visit the ARM website: www.arm.gov

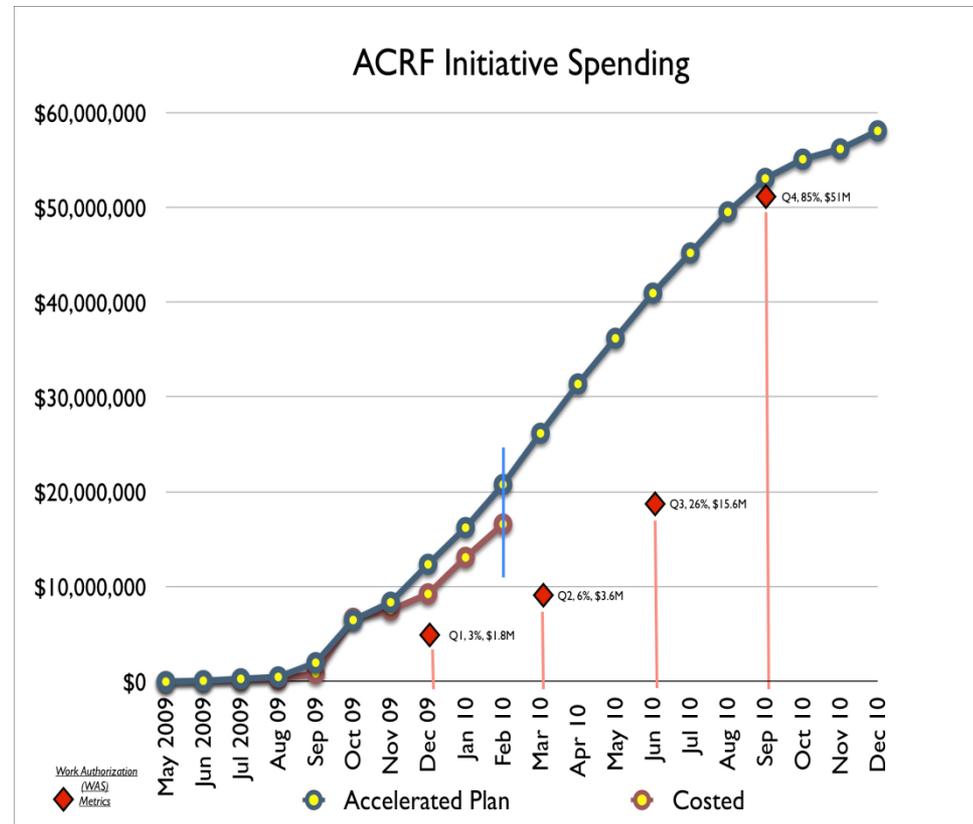
Or follow us on Facebook ( from the ARM homepage)

Thank You !



Progress and Where We Are

- 93% of the project costs are committed
- 22% of the project is costed
- Target 85% of project costed by FY2010 end
- Project completion by January 1, 2011



Field Campaigns

- Focused short-term research activities targeted to address specific science questions
- Provides supplemental measurements to increase routine data and test and validate new instruments
- Provides extensive field data to be analyzed and applied to improve computer models

Other Ways to Get Involved

- Download data (archive.arm.gov)
- Provide feedback regarding instruments, data, etc. (www.arm.gov/about/contact)
- ARM Contacts:
 - Jim Mather, Technical Director – jim.mather@pnl.gov
 - Jimmy Voyles, Instrument and Field Campaign Coordinator – jimmy.voyles@pnl.gov
 - Raymond McCord, Data Archive – mccordra@ornl.gov

Visit the ARM website: www.arm.gov

Or follow us on Facebook ( from the ARM homepage)